OPEN FRAME TRAY CLIP

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

[0001] This application is related to U.S. Patent Application entitled "Bare Die Tray Clip" [Attorney Docket No. 617810-0303800] filed the same day as this application, and which is expressly incorporated by reference herein.

[0002] This invention relates generally to apparatus for securing trays that are used in storing or transporting components such as semiconductors, and more particularly to an open frame clip for securing a stack of trays and a cover that places stack compression forces on tray perimeters for accommodating large tolerances in stack heights, and provides a clear view of a tray label and improved clearance for operator access to insert and remove a stack.

DESCRIPTION OF THE PRIOR ART

[0003] Small components such as semiconductors are often stored or shipped in molded plastic trays such as tray 10 shown in Fig. 1. With the components (not shown) in pockets 12, a cover such as cover 14 is placed over the tray 10 for captivating the components in the pockets 12. It is then often necessary to apply a device to secure the top 14 to the tray 10. For example, Fig. 2 illustrates a two part clip apparatus 16 used to clamp a tray and cover together, or a stack of trays and a cover together. The height of leg 18 is designed to accommodate the height of the stack. Fig. 3 illustrates the use of a two part clip apparatus 20 for securing a cover 22 to a tray 24. Fig. 4 illustrates another type of tray clip 26.

[0004] In order for the stack of trays to be secure, the clip provides a compressive force to the stack. Prior art designs apply force to a central area of the bottom of the stack, which eventually causes permanent warp/distortion of the trays. Prongs such as 28 (Fig. 2) are used at the stack top, with the opposing force in the central area of the bottom of the stack. In Fig. 2, each of the extensions 30 slide under the corresponding mating part and provide an interference, causing the

base 32 to bend in a manner that results in the clip applying a spring force when the clips are installed on a stack.

[0005] Fig. 4 shows another clip apparatus 26 with two leaf springs 34 for application of force to a stack inserted in the clip 26. The designs of Figs. 2-4 apply a leverage to the tray, operating between each of the top prong contact points and the corresponding area of contact on the central area of the bottom of the stack. The leverage applied to the tray by the spring force is proportional to the distances roughly indicated for example by dimensions D_1 and D_2 resulting in application of a bending force to the trays. This force causes damage due to the application of the force in the thin and weak central area. As the trays warp over time, gaps are produced between trays in a stack. In some cases, the components stored in a tray can fall through the gaps, or be pinched in a gap, causing damage to the component. In addition, when a stack of trays is removed from a clip, and a tray is presented to an automated pick and place machine, the warped, distorted tray can cause pick-up errors.

Fig. 5 shows another prior art clip 36 for holding a stack of trays 38. The structure is a rigid box fame 40 with openings 42 and 44 on the top and bottom for finger access to slide the stack out an opening 47 of the clip 36. Four leaf springs 46, including two on the top and two on the bottom, apply pressure to the top and bottom of the stack 38 to hold it in place. A disadvantage of this design includes the pressure of the springs 46 located within the more fragile central area of the trays, and the limited openings 42 and 44 which obscure the view of the tray labels. Also, the springs 46 do not allow enough motion to properly accommodate stacks of trays with minimum or maximum tolerances.

SUMMARY

[0006] It is an advantage of this invention in that it provides an improved clip for securing a stack of trays that minimizes warp due to tray clip forces.

[0007] It is a further advantage of this invention in that it provides a clip for securing a stack of trays that confines the retaining forces to the tray edges and therefore minimizes leverage to the stack and reduces tray warpage.

[0008] In one embodiment of the present invention, a clip is provided for holding a stack of trays and a tray cover. The clip has a base having a width providing clearance for a width of a tray and a cut-away relief area for finger access. First and second opposing resilient side walls and a

back wall that is also preferably resilient extend upward from the base, forming a structure with an open front and top. First and second resilient, elongated and downwardly curved members are included, each having a proximal end attached to an upper front of a corresponding side wall, and a distal end attached to the back wall. The resilient members are positioned so as to apply pressure to first and second opposing perimeter portions of a tray placed in the clip.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Fig. 1 shows a prior art tray and cover;

[00010] Fig. 2 illustrates a prior art two piece clip;

[00011] Fig. 3 illustrates a clip of the type shown in Fig. 2 holding a stack;

[00012] Fig. 4 shows a prior art clip having two centrally located springs for applying stack pressure;

[00013] Fig. 5 shows another prior art clip in the form of a box frame;

[00014] Fig. 6 illustrates an embodiment of the present invention as an open frame clip for storing a stack of trays;

[00015] Fig. 7 shows a stack installed in the clip of Fig. 6;

[00016] Fig. 8 illustrates a method of inserting a stack in the clip of Fig. 6;.

[00017] Fig. 9 is a planar, cross sectional view illustrating the flexible side walls for displacing stack retainer tabs, for allowing entry and exit of a stack; and

[00018] Fig. 10 is a side planar view of the clip for illustrating the flexible spring action of the combination resilient back wall and elongated resilient member, for accommodating large tolerances in stack height.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[00019] While the present invention will be described herein with reference to particular embodiments thereof, a latitude of modifications, various changes and substitutions are intended, and it will be appreciated that in some instances some features of the invention will be employed without a corresponding use of other features without departing from the spirit and scope of the invention as described with respect to the preferred embodiments set forth herein.

[00020] Referring now to Fig. 6 of the drawing, an open frame clip 48 according to the present invention is shown in a perspective view. The clip 48 is configured for storing a stack of trays, or trays and a tray cover in a chamber 49. The clip 48 housing has a base 50 with a tray storing area of width "W" and depth "D". The base 50 has a cut-out 52 extending inward from a front edge 54 of the base 50 allowing access for an operator's finger for gripping the bottom of a stack of trays. First and second sidewalls 56 and 58, constructed of resilient material extend at substantially right angles to the base 50 from opposing first and second base edges 60 and 62. The top 51 and front tray entry 53 are notably open, facilitating operator installation and removal of a tray stack, and allowing a clear view of stack labeling. The side walls 56 and 58 are unsupported on at least two edges having no connection between them on the upper edges 55 and 57 and front edges 59 and 61. A back wall 64, also constructed of resilient material, allows for movement as described further herein, is attached to a rear edge 65 and extends orthogonally from the base 50. The clip can be constructed from any of various materials that will be apparent to those skilled in the art. For example, polycarbonate or polypropylene, or either of these with a carbon filling which adds an anti-static property. Methods of construction of the clip will also be apparent to those skilled in the art, such as molding. These construction materials and methods and others that will be apparent to those skilled in the art are included in the spirit of the present invention. A portion L_1 at the back wall 64 joins at right angles to rear edges of the first and second side walls 56 and 58, leaving an unsupported back wall portion L_2, which portion is preferably resilient. The length L_2 of the back wall is preferably also resilient to add flexible motion in cooperation with elongated first and second resilient members 66 and 72 for accommodating large tolerances in a height of a stack to be stored in the chamber 49.

[00021] The first resilient, elongated and curved spring member 66 has a distal end 68 connected substantially adjacent a first upper corner portion of the resilient back wall 64, and is connected at a proximal end 70 to an upper front end of the first side wall 56. The member 66 extends over an area adjacent to the first side wall 56 and interior to the chamber 49 between the first and second side walls for applying pressure on a first side of a top perimeter area of a stack of trays. Similarly, the second resilient, elongated and curved member 72 is connected at a distal end 74 substantially adjacent a second upper corner part of the back wall 64, and is connected at a proximal end 76 to an upper front end of the second side wall 58. The member 72 extends over an area

adjacent the second wall 58 and interior to the chamber 49 between the first and second side walls so as to apply pressure on a second side of a top perimeter area of a stack of trays.

[00022] First and second tabs 78 and 80 extend inward of the chamber 49 from a front portion of the side walls 56 and 72 respectively for captivating a stack of trays placed in the clip 48. The operation of the tabs will be explained in reference to the following figures of the drawing.

[00023] Fig. 7 shows a stack of trays enclosed in the chamber 49 of the clip 48. The stack 82 has been inserted through the front opening 84 of the clip. In order to insert the stack, the tabs 78 and 80 in one embodiment are configured with a tapered input plane such as plane 86 of tab 80. As the stack is pushed into the opening 84, the stack pushes against the surfaces 86, causing the walls 56 and 58 to bend outward. With the stack 82 inserted past the tabs 78 and 80, the resilient walls 56 and 58 collapse back to their rest state, which places abrupt edges 88 and 90 in the path of the tray stack 82, which keeps the stack from exiting out the opening 84. In order to remove the stack, an operator forces the walls 56 and 58 outward so as to move the tabs out of the path of exit of the stack, and gripping the stack through the access 52 (Fig. 6) and the open top 51, pulls the stack out the opening 84. The height of a stack in the clip 48 is securely held by the springs 66 and 72 pressing on the perimeter areas 92 and 94 of the stack, forcing the stack against the base 50. The movement of the springs 66 and 72 is facilitated in part by corresponding outward movement of the resilient upper portion L_2 of the back wall 64. The thickness of the wall 64 and the length L_2, and the degree of curvature of the elongated members 66 and 72 can be designed to allow the required flexible, resilient movement to accommodate stack tolerances. Arrow 96 indicates the direction of movement of the wall 64 as the springs 66 and 72 move in the direction indicated by arrows 98.

[00024] Fig. 8 illustrates a stack 82 in position for sliding into the front opening 84 of the clip 48.

[00025] Fig. 9 is a cross sectional view A-A from Fig. 6 for illustrating the outward movement of the walls 56 and 58, indicated by the dashed lines. In order for a stack to be inserted and removed from the chamber 49, the tabs 78 and 80 are moved outward as indicated by arrows 99 and 100 by bending the resilient walls 56 and 58.

[00026] Fig. 10 is a planar view of side 56 of the clip 48 for describing more clearly the operation of the flexible, resilient back wall 64 in cooperation with the elongated members 66 and 72. The dashed line 102 represents the outline of a stack placed in the clip 48. The upper perimeter

area is represented by portion 104 of the dashed outline 102. Fig. 10 shows member 66 and back wall 64 in a relaxed state prior to inserting the stack by the solid lines. The dashed lines 106 represent the member 66 and back wall 64 position upon insertion of the stack, which forces the spring 66 upward, which causes outward movement of back wall 64.

[00027] The preferred embodiment as described above, and variations that will be apparent to those skilled in the art, limit the application of pressure to the perimeter areas of a tray. As a further alternate embodiment, pressure can additionally be applied to non-perimeter areas and these additions that will be apparent to those skilled in the art are included in the present invention.

[00028] While the present invention has been described herein with reference to particular embodiments thereof, a latitude of modifications, various changes and substitutions are intended in the foregoing disclosure, and it will be appreciated that in some instances some features of the invention will be employed without a corresponding use of other features without departing from the spirit and scope of the invention as set forth in the appended claims.